

Appendix 2

Detailed record of SAC features present on Catfield Fen SSSI Unit 3 and Sutton Fen SSSI Units 8, 10 & 24

Introduction

1. This note provides a detailed record of the type and area of key SAC vegetation communities found on Catfield Fen SSSI Unit 3 and Sutton Fen SSSI Units 8, 10 and 24. The key features covered are:
 - 7210 Calcareous fens with *Cladium mariscus* and species of the *Caricion davallianae*
 - 6410 *Molinia* meadows on calcareous, peaty or clayey-silt laden soils (*Molinion caeruleae*)
 - 7140 Transition Mires and Quaking Bogs
 - 3140 Hard oligo-mesotrophic waters with benthic vegetation of *Chara* spp
 - 3150 Natural eutrophic lakes with *Magnopotamion* or *Hydrocharition*-type vegetation
2. A summary of the following information is provided within Section 3 of the RSPB's main response to the Catfield water abstraction licence renewal "minded to" decision consultation.

7210 Calcareous fens with *Cladium mariscus* and species of the *Caricion davallianae*

3. At Catfield Fen, the Calcareous fen SAC feature is represented at Unit 3 by stands of S2 (4.8Ha) and S24 (11.6Ha).
4. In Unit 3, S24 is mostly represented by the S24e (*Cicuta virosa*), S24d (typical), S24f (*Schoenus nigricans*) and S24g (*Myrica gale*) subcommunities. S24e is particularly important for the range of nationally rare species of plants it supports, including Fen Orchid.
5. S24e is widespread in Unit 3. It occurs in both managed and unmanaged open fen, on both solid and previously turf ponded fen, though with more of an affinity to the latter, where it is the dominant plant community in Unit 3. S24e is one of the most species-rich fen communities in the Broads, with an average of 24.4 species per 4m quadrat (Broads Authority, 2010) and supports a range of nationally rare species including: Milk parsley *Peucedanum palustre*, Greater water-parsnip *Sium latifolium*, Cowbane *Cicuta virosa* and, most notably, Fen orchid, *Liparis loeselii*. The S24e on Unit 3 is not as species-rich as that at Sutton Fen with many of the nationally rare species less frequent. The S24e is mostly not part of the SAC Calcareous Fen feature due to the relative scarcity of *Cladium*.
6. There has been a measured loss of S24e on Unit 3 of at least 1ha since 1986^{1, 2} (&), though in the absence of detailed NVC mapping of the whole site, this figure could be higher. This loss threatens the Annex II SAC feature fen orchid *Liparis loeselii*. At both Catfield Fen and Sutton Fen, fen orchid is only known to occur on S24e vegetation (though there may be S27 and M9 communities on Sutton Broad that have not been identified in recent surveys).

¹ RSPB (2014) A survey of *Sphagnum* moss at BC Catfield Fen –redacted.

² RSPB (2014) An assessment of *Sphagnum Liparis* on BC Catfield Fen – redacted.

7. An unclassified community dominated by *Sphagnum* moss that develops from S24 is spreading and consequently reducing the areas of S24, particularly S24e (RSPB, 2014a & 2014b). This *Sphagnum* community is named BS5 in Broads Authority 2010 and is thought to occur when a perched acid water layer allows establishment of *Sphagnum* on a previously calcareous fen. Deep rooted calcareous species survive, at least for a time, though are eventually lost as acidity increases. Though confirmation is required by JNCC, it is considered that BS5 is part of the SAC transition mire feature described below.
8. S24d and S24g are widespread in Unit 3, the latter particularly in drier fen areas. These communities are particularly valuable for fen invertebrates, providing the wet, cool, shady conditions favoured by many groups such as the *Diptera*. They are also valuable for nesting passerines, particularly grasshopper warblers and Cetti's warblers (R. Mason *Pers. Comms.*). However, their plant diversity is poor relative to S24e. Parts of these sub-communities qualify as the SAC Calcareous Fen feature where *Cladium mariscus* is abundant.
9. S24f is also widespread in Unit 3, generally occurring in a mosaic with S2, together these two communities cover about 4.8ha. The S24f community is generally within areas historically and presently cut for commercial sedge in slightly wetter parts of the site, mostly on solid peat. The S2 is mostly on turf ponded areas undergoing succession from open water. These areas are very wet and mostly unmanageable, though some areas are cut commercially in drier years. Both of these communities are part of the Calcareous Fen SAC feature due to their abundance of *Cladium mariscus*.
10. The *Peucedano-Phragmitetum caricetosum*, recognised by both Rodwell (1995) and in the ecohydrological guidelines (2004), is probably no longer present at Catfield. However, this community may still occur on Sutton Broad, but further survey is required to confirm its presence.
11. At Sutton Fen, the Calcareous fen SAC feature is represented by stands of S2 (14.0ha) and S24 (77.0ha). The communities occur in a mosaic with areas of S2 dominant on former and historic commercial sedge beds and S24 widespread throughout most of the open fen area under a variety of management treatments (see Appendix 8 regarding site management).

6410 *Molinia* meadows on calcareous, peaty or clayey-silt laden soils (*Molinion caeruleae*)

12. Very small areas of M24 are known from both Unit 3 and Sutton Fen (particularly SSSI unit 8; R. Mason *Pers. Comms.*), but these were not picked up on the 2010 Broads Authority survey. Due to a lack of detailed survey data, little is known about this community at either Unit 3 or Sutton Fen, but if its presence is confirmed it would qualify as the SAC *Molinia* meadow feature.

7140 Transition Mires and Quaking Bogs

13. S27, M9 and M5 are considered the only examples of the SAC transition mire feature in the Broads in the JNCC SAC description. M5 is absent from Catfield and Sutton Fen. The upland margins of Sutton Broad are known to be a complex mosaic of S24 sub-communities. However, recent restoration has increased habitat diversity and the mix of communities may represent S27, M9 and M24, as well as S24. This area needs closer study to identify the presence or absence of SAC features. If this small area does hold these communities it would confirm its

reputation as perhaps the most important area of fen in the UK, with 4 separate SAC habitats present in close proximity (7210, 6410, 7140 and 3140), which together support 3 SAC species (fen orchid, otter, Desmoulin's whorl snail).

14. No S27 or M9 are known on Unit 3, though both may have been present in the past and lost.
15. The BS5 community proposed by the Broads Authority (2010) report is well represented in Unit 3, with 3.0ha recorded in 2014 (RSPB, 2014a & 2014b). This is known to be increasing (with 1.82ha recorded in 1986) largely through the spread into S24 community areas, particularly S24e. The BS5 community is valuable in supporting the nationally rare *Dryopteris cristata* and some other plants generally scarce in Broadland such as *Drosera rotundifolia*. It has been observed at Unit 3 that over time, there is continued reduction in abundance of characteristic S24 species with eventual loss of all but the woody species and the dominant monocotyledons. Species such as *Peucedanum palustre*, *Sium latifolium* and *Cicuta virosa* are able to persist for a few years but are eventually lost. Though not mentioned in the SAC feature description, this community appears to fit the qualifying features of the SAC Transition mire feature and is certainly a valuable community in conservation terms, though at the expense of other important features, notably Fen Orchid. There are small (<0.5ha) areas of BS5 at Sutton Fen that also appear to fit the qualifying features of the SAC Transition mire feature. Unlike at Unit 3, these areas are not spreading.

3140 Hard oligo-mesotrophic waters with benthic vegetation of *Chara* spp

16. There are recent records of *Chara*-dominated pools in Unit 3, including the turf pond to the south-west of [REDACTED] and the open water in [REDACTED]. There were also areas of wet fen known to support a range of species associated with this feature such as *Chara* spp., *Utricularia* spp. and *Potamogeton coloratus*. Whilst *Chara* and *Utricularia* both persist in Unit 3, their distribution and quantity is much reduced. They are now very rare, occurring in small patches growing in the few areas of very wet fen that retain alkaline pH water at the surface for most of the year. The turf pond to the south west of [REDACTED] has become unsuitable due to reduced pH (5 samples with pH of 6.52, 6.52, 6.50, 6.42 and 6.82). The open water on [REDACTED] remains mostly alkaline and retains small patches of *Chara* spp. The new turf pond on [REDACTED] has failed to colonise with *Chara* spp. after 3 years, which is also likely due to low pH. The SAC Hard oligo-mesotrophic waters feature is now likely absent from Unit 3, though it is known to have been present in the recent past.
17. At Sutton Fen there are many small turf ponds in the peat that have been dug within the last 40 years and there are many areas of very wet alkaline open fen that support this feature within the water layer, usually at the base of S24 vegetation. This feature has not been studied in detail at Sutton Fen, so records are sparse. However, the *Chara*-dominated areas are known to include: *Chara virgata*, *Chara aculeolata*, *Chara globularis*, *Chara vulgaris* and *Chara hispida*, with *Baldellia ranunculoides*, *Utricularia minor*, *Utricularia intermedia* and *Potamogeton coloratus* also present. These are likely to be amongst the best examples of the SAC Hard oligo-mesotrophic waters feature in the Broads. In addition to the peat turf ponds and open fen that support this feature, there are also stretches of ditches and new pond complexes dug into the crag that also hold *Chara* spp. and may qualify as this feature. Notably most of the ponds have

pH in excess of pH8 and as high as pH9. This very high pH status water is highly likely to be groundwater fed (see Appendix 9).

3150 Natural eutrophic lakes with *Magnopotamion* or *Hydrocharition*-type vegetation.

18. This feature is well represented throughout the Broads' dyke network. At Unit 3 and Sutton Fen, the peat dykes (1.1km and 11km respectively) support this feature with vegetation dominated by *Stratiotes aloides*, *Myriophyllum verticillatum* and *Potamogeton natans*. A wide range of other emergent and submergent plants are also present, including some *Chara* spp. and fine-leaved *Potamogeton* species. Sutton Broad and a few larger old turf ponds at Sutton Fen may also support this feature, totalling approximately 9ha.

Appendix 3

Ant Broad and Marshes SSSI Fen Orchid (*L. loeselii*) survey results 2014

Royal Society for the Protection of Birds, September 2014

Introduction

1. This report summarises the currently available fen orchid survey data from the UK with a focus on the Ant Broad and Marshes SSSI.
2. Three separate surveys have been carried out in the Ant Broad and Marshes SSSI in 2014:
 1. South Sutton Broad [REDACTED] Plantlife, Pending completion and reporting
 2. Catfield Fen [REDACTED], RSPB, Complete
 3. The Wider Catfield and Irstead Fens [REDACTED], The Landscape Partnership, Complete
3. Summary reports and maps of these three surveys are given below, with population estimates where appropriate and maps showing individual orchid plant locations.
4. The South Sutton Broad survey is pending completion and reporting, so the 2013 data is used here instead, supplemented by provisional 2014 data and informal surveying.
5. See “Definitions” at the end of this Appendix for terms, such as ‘Spike’ and ‘Colony’.

2013 / 2014 Monitoring data

South Sutton Broad 2013 (with reference to incomplete 2014 survey)



Figure 1: South Sutton Broad Fen orchid count 2013

White block = Not counted

Red block = Full count in 2013

Number = total number of Fen orchid spikes found in block (blank in red block = 0)

6. Since 2012, Plantlife has been employed by the RSPB to complete a detailed survey of a 3ha area of [REDACTED]. The survey area is split into 80 areas that coincide with blocks of cut fen. 39 blocks were counted in 2013 with a total of 1326 orchid spikes found. In 2014, there has been a notable increase in the number of fen orchids counted. The higher counts appear to be mostly within the main clusters of plants. The population count for 2014 recorded 1538 spikes. Whilst these counts provide a good indication of the size of the population they are only partial counts of the full area that the fen orchid colony occurs.
7. There is an additional small colony of 30 spikes to the far East of Sutton Broad, not included within the above data that were counted in 2014.

Catfield Fen [REDACTED] on Butterfly Conservation land, SSSI Unit 3

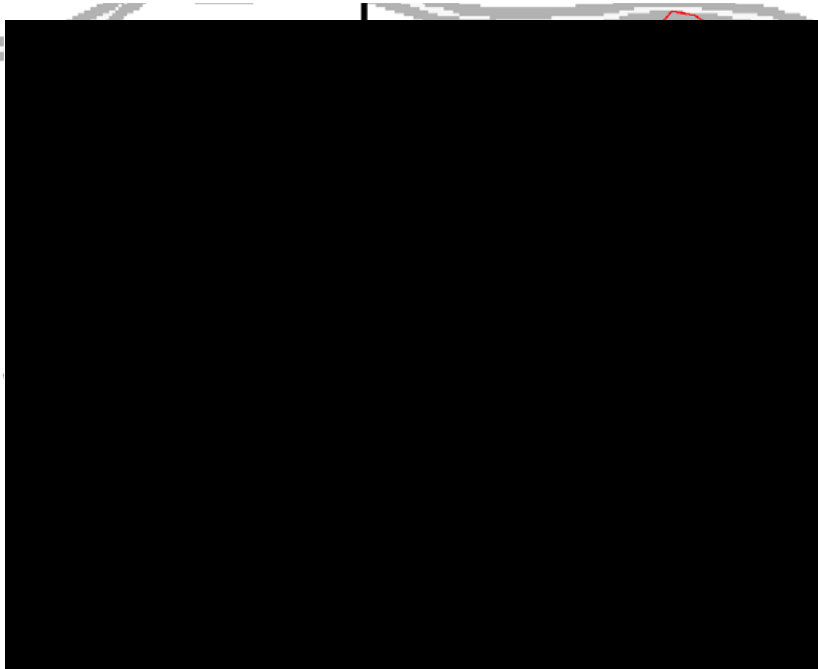


Figure 2: Catfield [REDACTED] orchid count 2014

Red outlined blocks = Areas counted in 2014

Red stars = Fen orchid plant

8. The colony on [REDACTED] Unit 3, was found in 2009 and was monitored using various methods. Since 2013, a long term method was agreed with Plantlife and has been included in the site's SSSI management plan. This is to be reviewed to ensure the most appropriate survey method is being applied given the importance of establishing accurate population figures to identify population trends in the future.
9. Since 2013, RSPB has been monitoring the colony on [REDACTED]. A full count is carried out on all reed plots cut in the preceding winter. As part of the reedbed is on a 4 year rotation, the whole

area has not yet been counted, so the 2013 and 2014 results are partial surveys with some overlap between years.

10. In 2014, 4 of the 9 survey blocks were counted, with a total of 1843 spikes found. This represents a notable increase in orchid numbers within blocks compared to 2013 data. The increase seems to be across all blocks, though there has been a loss of c.25 plants (60 spikes) from the north-west corner where *Sphagnum* encroachment is taking place.

The Wider Catfield and Irstead Fens

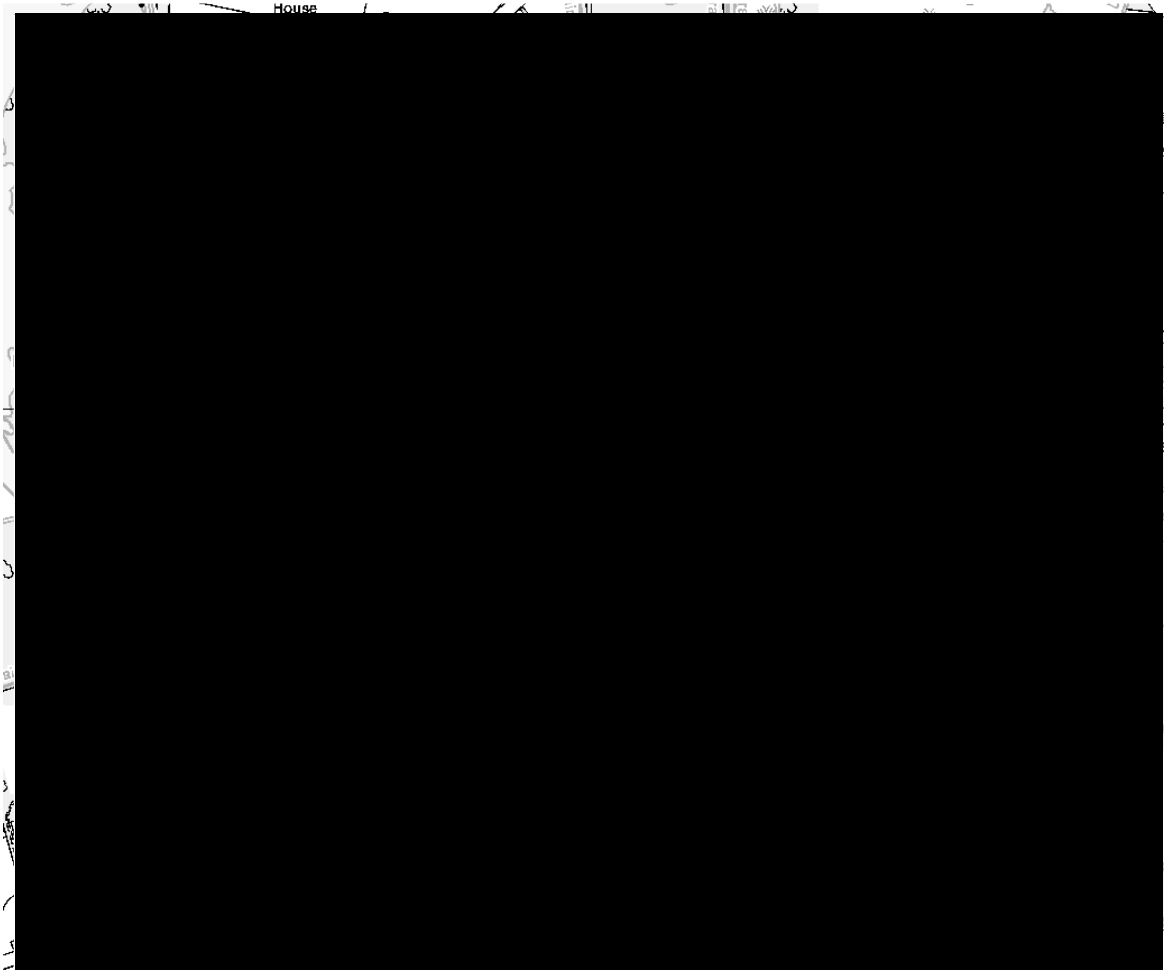


Figure 3: Catfield and Irstead Fens survey 2014

Green outlined blocks = Areas searched and counted in 2014

Green stars = Fen orchid plant

11. The Landscape Partnership were employed by the RSPB to thoroughly search potentially suitable habitat within the Ant Broad and Marshes SSSI for fen orchid in 2014. Two known colonies at

Catfield Great Fen and [REDACTED] were found and counted with 187 and 83 spikes found respectively. No other, new, colonies were found. The 1 plant found at Catfield Hall Estate in 2013 was not re-found in 2014. Much of the remaining fen in the Ant valley is unsuitable for fen orchid. However, it is possible that unknown colonies may occur in isolated areas within the Ant valley.

Summary of known fen orchid locations within the Ant Broads and Marshes SSSI

Table 1: Most up to date counts of fen orchid colonies within the Ant Broads and Marshes SSSI. All numbers are number of 'spikes'			
	SSSI Unit	2013 count	2014 count
<i>Sutton Broad</i>			
[REDACTED]	[REDACTED]	1326 (partial)	1538 (partial)
[REDACTED]	[REDACTED]	23 (full)	30 (full)
<i>Catfield Fen</i>			
[REDACTED]	[REDACTED]	964 (partial)	1843 (partial)
[REDACTED]	[REDACTED]	3 (partial)	83 (full)
[REDACTED]	[REDACTED]	1(partial)	0 (full)
[REDACTED]	[REDACTED]	Not surveyed	187 (full)
Total		2317	3469

All numbers are number of 'spikes'

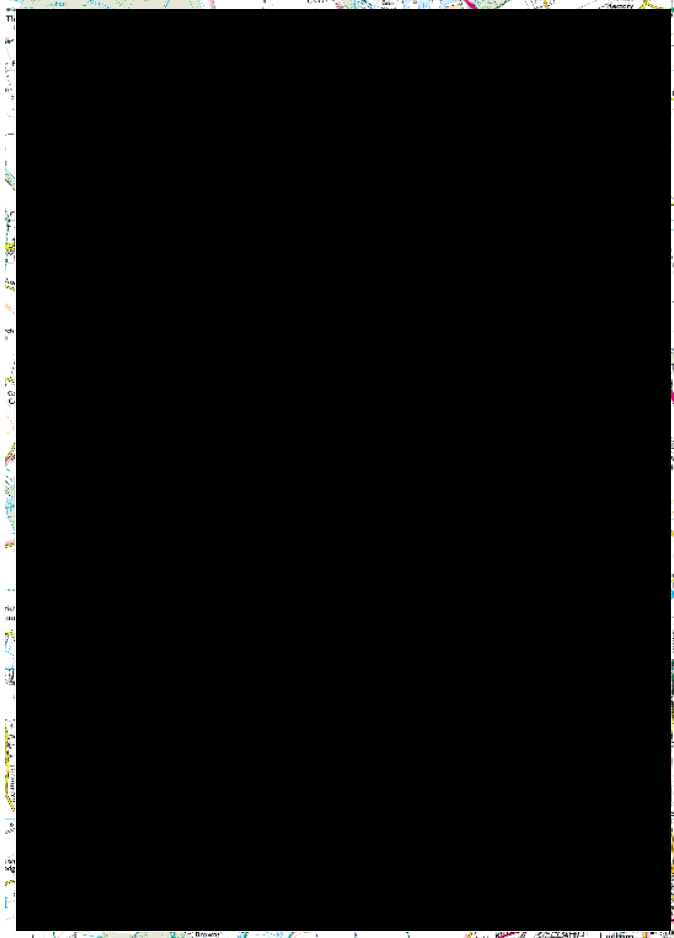


Figure 4: Recorded fen orchid locations within the Ant Broads and Marshes SSSI

Red outline = Ant Broads and Marshes SSSI boundary

Red dots = Centre of colonies

Summary of known UK colonies outside the Ant Broads and Marshes SSSI

12. There is an established population at Upton Fen which has been regularly monitored by the Norfolk Wildlife Trust. The population is known to fluctuate significantly over time and in 2013 it is understood that there were 12 spikes found. However, for confirmation and up to date information, NWT should be consulted.

13. The only other known fen orchid site outside the Broads in the UK is Kenfig Dunes where 45 plants were recorded in 2013 and a similar number in 2014 (David Carrington, *Pers. Comm.*).

Table 1: Most up to date counts of fen orchid colonies within the Ant Broads and Marshes SSSI. All numbers are number of 'spikes'			
Other UK colonies	SSSI Unit	2013 count	2014 count
██████████ (Broads) ²		12 (full)	38 (full)
Kenfig Dunes (Bridgend, Wales) ³		45 (full)	40 (partial)
Total		57	78

All numbers are number of 'spikes'

¹ The introduced population at Ranworth is not included - the plants are of non-UK origin and are not considered part of the native fen orchid population.

² Personal Communication with Tim Pankhurst (Plantlife), figure not verified.

³ *Liparis loeselii Ovata* (Dune variety) subspecies.

Discussion of fen orchid data from 2014

14. In 2014, in the UK, fen orchids were found in 4 locations. Within Sutton Fen and Catfield fen different colonies or sub-colonies exist. The estimated combined population size of these colonies ranges from 2374 spikes in 2013 to 3547 spikes in 2014. The majority of the UK's fen orchids are found on a few sites in the Broads, with one colony (of subspecies *L. l. Ovata*) found in Wales.
15. The Ant Broads and Marshes SSSI hold over 99% of the known UK population of fen orchid. Over 97% of the UK population is confined to two locations (Sutton Broad South and Catfield ██████████ ██████████).
16. Any assessment of population trends of orchids over short timescales is difficult, as fen orchid populations fluctuate annually and are sensitive to a range of biotic and abiotic factors.
17. For further assessment of the Catfield ██████████ population and the potential threat of hydrological change and *Sphagnum* spp. expansion see the separate report titled 'Catfield ██████████ fen orchid survey 2014, RSPB'.

Definitions

Fen orchids in the Ant valley have a fairly typical and consistent growth form, they generally occur as a cluster of spikes growing in close proximity. These clusters are usually one plant all having originated from the initial coloniser (which could have germinated from seed or propagated asexually from plant material). Over time the plant sends up new spikes, some of which flower, but often do not. For the sake of clarity, below are the definitions used in this report:

Non flowering spike – the (usually smaller) spikes of 1 or 2 leaves that do not bear a flowering spike.

Flowering spike – the (usually larger) spikes of 2 leaves that do bear a flowering spike (though at the time of survey the actual flowers may be yet to bloom, or may have gone to fruit).

Spike – both flowering or non-flowering spike, this is generally used as the total population count (total number of spikes).

Plant – The group of flowering and non flowering spikes that make up one plant. This is subjective (which is why it is not used for the population count), as sometimes plants are growing adjacently and it is impossible to separate one plant from the next. However, this is generally used for mapping purposes as it is generally not practical to present a map showing each individual spike (as they can grow in such close proximity).

Cluster – A cluster of plants. Often fen orchids in the Ant valley have a ‘clumpy’ distribution and within a colony are often found clustered into a few small areas with outliers in between.

Colony – A discrete colony of plants separate from other colonies by a barrier (for example, a ditch, scrub, unsuitable fen).

Block – A survey area, often coinciding with a management area (a reed plot for example).

Appendix 4

2014 Fen orchid *Liparis loeselii* survey report for [REDACTED] on the Butterfly Conservation reserve at Catfield Fen

Royal Society for the Protection of Birds, 2014

Introduction

1. In early 2014, the RSPB produced two reports on *Sphagnum* moss and fen orchid at Catfield Fen^{1,2}. This report is an update following 2014 survey work undertaken by the RSPB in [REDACTED]. The survey recorded a significantly greater numbers of fen orchids within the colony than in previous surveys, but a loss of individual plants from the colony area where *Sphagnum* encroachment is most significant.

2014 Survey results

2. The 2014 Survey followed the same method as 2013. The blocks surveyed each year are those that were cut the preceding March (Figure 1). The survey method was not designed to pick up year-to-year change, but to provide a long term data set that could indicate the broad trend in the population over time. This is designed to act as an early warning system for rapid loss and to assess response to habitat management in the longer term.

¹ RSPB(2014). An assessment of *Sphagnum* moss and fen orchid *Liparis loeselii* on [REDACTED] and [REDACTED] at Butterfly Conservation Catfield Fen. RSPB

² RSPB (2014). A survey of *Sphagnum* moss at Butterfly Conservation Catfield Fen and comparison with past surveys. RSPB.

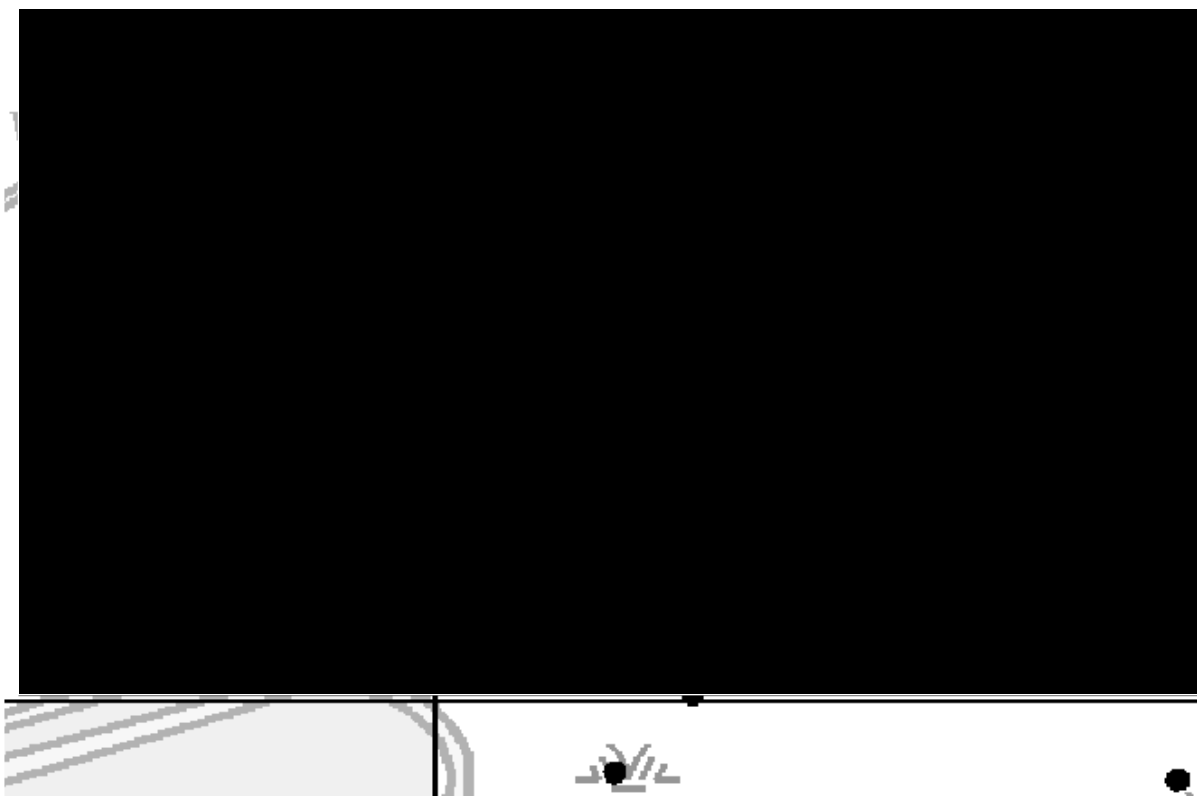


Figure 1: [REDACTED] Cutting plan and 2014 Fen orchid count area

Red blocks = Reed blocks cut on rotations

Blue blocks = Area cut in March 2014 and counted for fen orchid in June 2014

3. In March 2014, Blocks B, C, F, G, and part of block D were brushcut (with vegetation burnt on the fen in rows), and then surveyed for fen orchids in June 2014. Table 1 shows the numbers of spikes counted in 2013 and 2014 for each block. Figure 2 provides the distribution of spikes recorded in the two surveys.

Table 1: 2013 and 2014 Fen orchid counts at [REDACTED]

Block	Total spikes 2013	Total spikes 2014
A	-	-
B	-	128
C	860	967
D	90	589 (part)
E	-	-
F	-	57
G	6	102
H	8	-
Total	964	1843

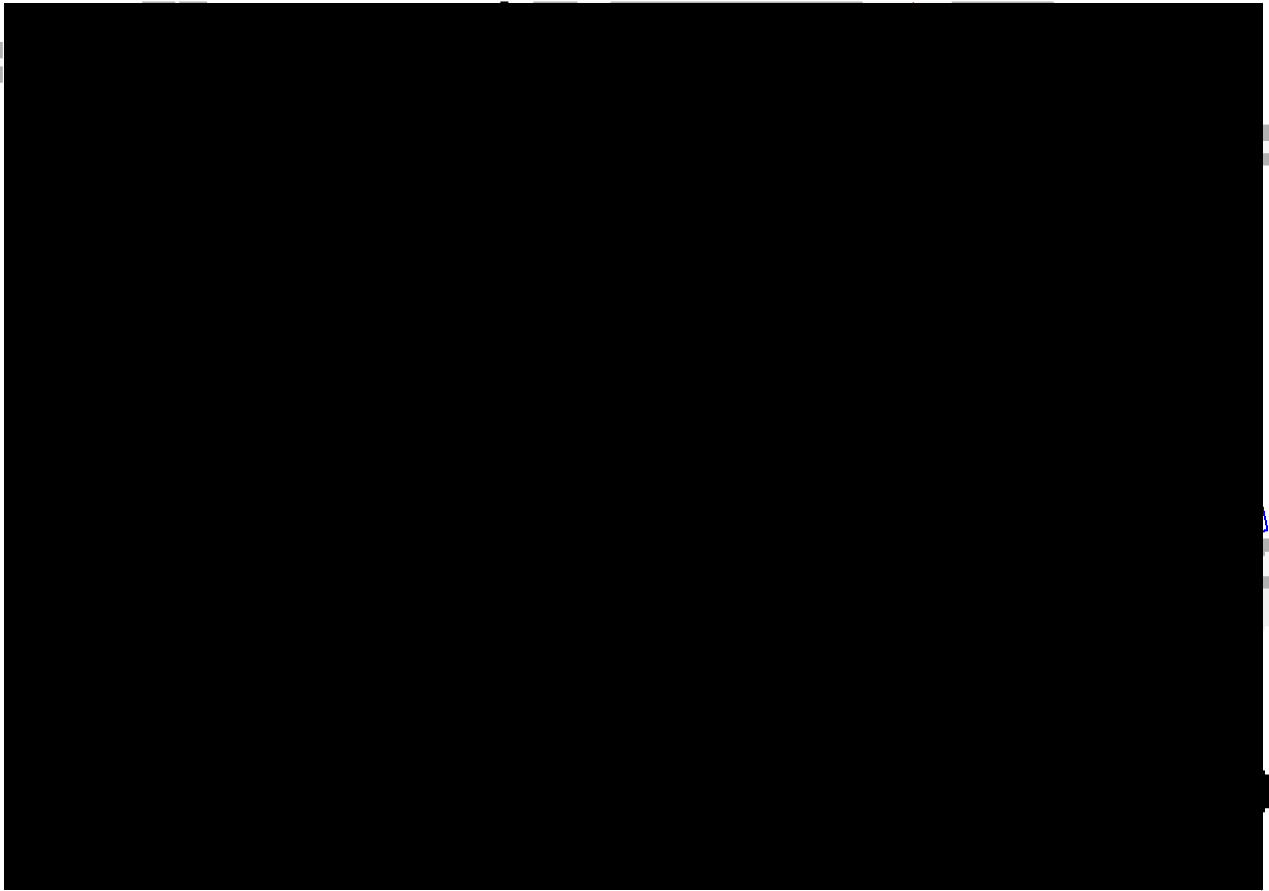


Figure 2: Map showing fen orchids counted in 2013 and 2014 at [REDACTED]

Blue star = Fen orchid plant 2013
Blue blocks = Area surveyed in 2013
Red star = Fen orchid plant 2014
Red blocks = Area surveyed in 2014

4. There is clearly a significant increase in number of fen orchid spikes within the blocks surveyed in both 2013 and 2014, especially blocks D (which was only partly surveyed) and G. This could be a response to suitable cutting management, burnt areas providing germination opportunities, the warm winter, hydrological change, natural cycle within the population, or other biotic and abiotic factors.
5. Since 2011, the colony has been placed under a management regime targeted specifically at maintaining and improving conditions for fen orchid. It is highly likely that this change in management has contributed significantly to the apparent population increase. However, this is based on a single year's count and more data will be required to understand trends and links to management in the longer term.

6. Blocks B and F were counted in 2014, but not in 2013 so no comparison can be made in these areas. Block B is an area of patchy *Sphagnum* and it will be important to re-survey this area in future years to detect any loss of plants to *Sphagnum* encroachment.
7. The population at Catfield [REDACTED] is now likely to be the largest colony in the UK, and holds 40 – 50% of the UK population.

Loss of Fen orchids to North of block C

8. Despite the excellent total count and apparently healthy population, there is still great concern for the long term prospects of the [REDACTED] population and the 2014 data provides new evidence showing an impact and a loss of fen orchids to *Sphagnum* moss encroachment between 2013 and 2014.
9. The RSPB has previously reported monitoring work showing a significant increase in *Sphagnum* moss on [REDACTED] since 1986³. Part of this *Sphagnum* is encroaching on the north western area of the fen orchid colony. The surveys in 2013 and 2014 have shown the fen orchids can persist in areas where *Sphagnum* cover is not total, but are absent from areas of *Sphagnum* dominance. Whilst a few individual plants may persist for a short period within increased *Sphagnum* areas, this is at the expense of the main colony, and represents a significant loss to the species for which Unit 3 is the UK stronghold, and is dependent on the microclimatic and habitat conditions within the area. The current work provides a good baseline, but the northern and western edge of the fen orchid colony will become increasingly more at risk. Unless suitable remedies are identified and agreed to address the increase in *Sphagnum* area, the potential available habitat for the colony is expected to decline over time, especially as the eastern edge is bounded by a drain.
10. Figure 3 shows the North of block C and indicates a loss of individual fen orchid plants between 2013 and 2014. This coincides with *Sphagnum* encroachment over just one year. Approximately 20 plants (60 spikes) found in this area in 2013 were not re-found in 2014.

³ RSPB (2014). 'A survey of *Sphagnum* moss at Butterfly Conservation Catfield Fen and comparison with past surveys. RSPB

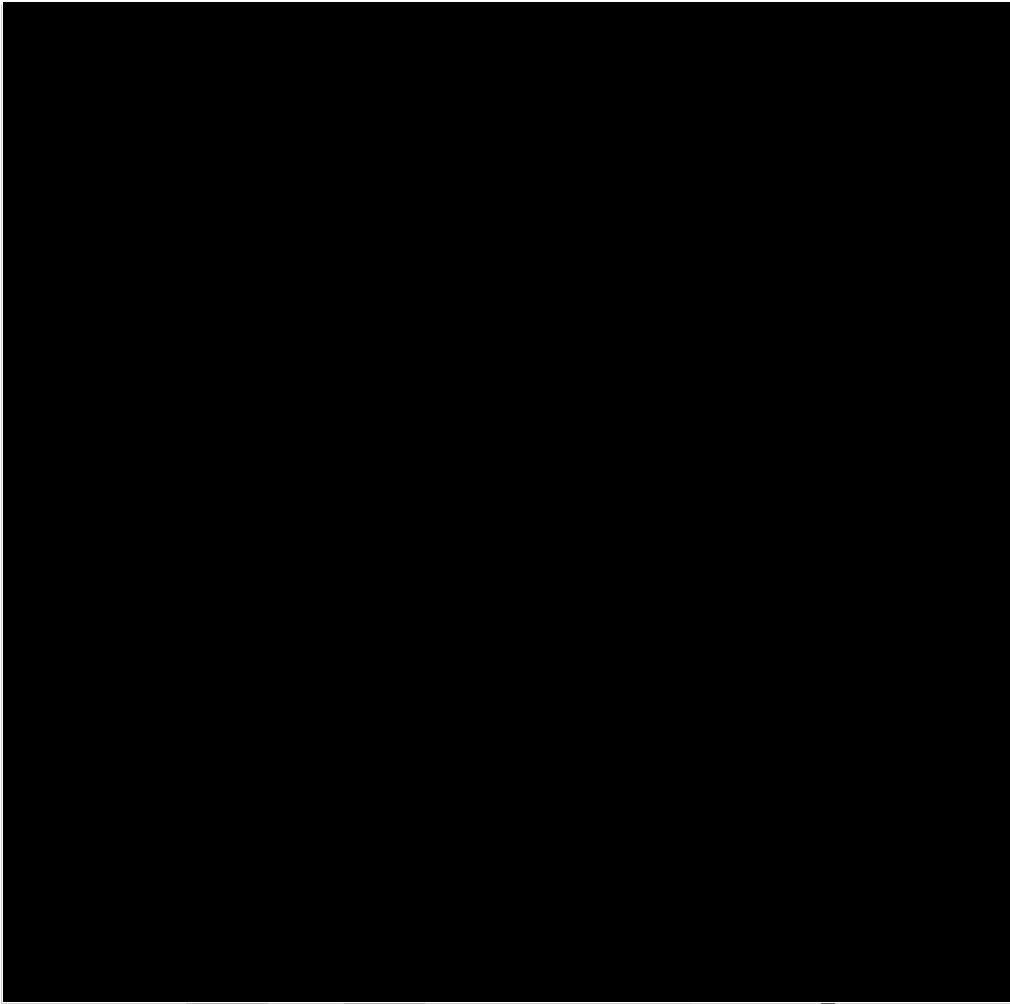


Figure3: Map showing loss of fen orchid to NW of colony

Red star = Fen orchid plant 2014

Red blocks = Area surveyed in 2014

Blue star = Fen orchid plant 2013

Blue blocks = Area surveyed in 2013

Black circle = Area of loss of fen orchids

Discussion of the fen orchid surveys

11. Unfortunately, there is not a historic data set that could demonstrate if there has been a gradual loss of fen orchid plants to the north west or west of the existing colony. A comparison between 2013 and 2014 is therefore the best data available to identify changes within the fen orchid colony. It appears that in general the population is healthy. However, *Sphagnum* spp. growth from the north west will be impacting this part of the colony and has resulted in the loss of fen orchid plants. Currently improved management to adjacent blocks to the E of this block has likely enabled improved conditions for fen orchid growth. This has potentially allowed the fen orchid colony to move further east. However, this potential easterly change in distribution will be limited due to the

unit being bounded by scrub and drainage ditches. Once the colony reaches such features it is anticipated that, absent appropriate remedies, the colony will start to decline as *Sphagnum* growth shows no sign of being halted and fen orchids are unable to survive the altered habitat conditions.

12. Due to the lack of data for block B in 2013, we do not know if there has been a similar loss from the west of the colony.
13. Both *Liparis* surveys highlight that over 90% of the known Mill Marsh population is within 35metres of the area of dominant *Sphagnum spp.* Between 1986 and 2014, the *Sphagnum* area on [REDACTED] [REDACTED] has spread up to 70m south and 50m east. A similar rate of increase (though there is anecdotal evidence that the rate of spread is increasing) could lead to a substantial loss of plants by 2020. In addition there are other areas of *Sphagnum* to the east of the main colony that are also expanding and placing further pressure on the fen orchid population.
14. This comparison on a year-to-year basis is not ideal and a longer term data set would be preferable. However, in the absence of a historic data set, this is the best empirical evidence of *Sphagnum* impacting on fen orchid, an SAC, Ramsar and SSSI feature, and further increases the importance of addressing the causes of *Sphagnum* encroachment at Catfield Fen.